

DAE

HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 200308558-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Nitzan Peleg et al.

Confirmation No.: 5363

Application No.: 10/690,762

Examiner: Timblin, Robert M.

Filing Date: October 22, 2003

Group Art Unit: 2167

Title: METHOD AND APPARATUS FOR REFRESHING MATERIALIZED VIEWS

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on July 10, 2007.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) \$500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month
\$120

☐ 2nd Month
\$450

☐ 3rd Month
\$1020

☐ 4th Month
\$1590

☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of \$ 500. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees.

☒ A duplicate copy of this transmittal letter is enclosed.

☒ I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to:
Commissioner for Patents, Alexandria, VA 22313-1450
Date of Deposit: September 10, 2007

OR

☐ I hereby certify that this paper is being transmitted to the Patent and Trademark Office facsimile number (571)273-8300.

Date of facsimile:

Typed Name: John Deasy

Signature: John Deasy

Respectfully submitted,

Nitzan Peleg et al.

By W. Allen Powell

W. Allen Powell

Attorney/Agent for Applicant(s)

Reg No. : 56,743

Date : September 10, 2007

Telephone : 281-970-4545



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Nitzan Peleg et al.

Serial No.: 10/690,762

Filed: October 22, 2003

For: METHOD AND APPARATUS
FOR REFRESHING
MATERIALIZED VIEWS

§
§
§
§
§
§
§
§
§
§
§

Group Art Unit: 2167

Examiner: Timblin, Robert M.

Atty Docket: 200308558-1/BLT/POW
NUHP:0073

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF TRANSMISSION OR MAILING
37 C.F.R. 1.8

I hereby certify that this correspondence is being transmitted by facsimile to the United States Patent and Trademark Office in accordance with 37 C.F.R. § 1.6(d), or is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4), or is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date below:

September 10, 2007
Date

Joan Deasy
Joan Deasy

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in furtherance to the Notice of Appeal mailed on July 6, 2007, and received by the Patent Office on July 10, 2007.

The Commissioner is authorized to charge the requisite fee of \$500.00, and any additional fees which may be necessary to advance prosecution of the present application, to Account No. 08-2025; Order No. 200308558-1.

1. **REAL PARTY IN INTEREST**

The real party in interest is Hewlett Packard Development Company, L.P., the Assignee of the above-referenced application by virtue of the Assignment recorded at reel 014632, frame 0113, and dated October 22, 2003. Accordingly, the Assignee of the

09/13/2007 HVUONG1 00000022 082025 10690762

01 FC:1402 500.00 DA

above-referenced application, will be directly affected by the Board's decision in the pending appeal.

2. **RELATED APPEALS AND INTERFERENCES**

The Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. **STATUS OF CLAIMS**

Claims 1-30 are currently pending, are currently under final rejection and, thus, are the subject of this Appeal.

4. **STATUS OF AMENDMENTS**

As the instant claims have not been amended at any time, there are no outstanding amendments to be considered by the Board.

5. **SUMMARY OF CLAIMED SUBJECT MATTER**

The Application contains six independent claims, namely, claims 1, 5, 9, 16, 23, and 27, all of which are the subject of this Appeal. The subject matter of these claims is summarized below.

With regard to the aspect of the invention set forth in independent claim 1, discussions of the recited features of claim 1 can be found at least in the below cited locations of the specification and drawings. By way of example, claim 1 relates to a system that allows a table and a materialized view to be available while the materialized view is being refreshed. The system comprises a materialized view (e.g., materialized view 130) that is derived at least in part from a table (e.g., table 128). *See, e.g.*, Application, paragraphs 2-4, 18, 20-22, 26-33, 37-76 and 81-84, and Figures 3 and 7. The system further comprises a refresh log (e.g., an excerpt of a refresh log 100) that contains a plurality of entries, each of the plurality of entries corresponding to a change in the table, each of the plurality of entries comprising an epoch identifier adapted to

synchronize the refresh log between refreshing operations. *See, e.g.*, Application, paragraphs 28-40 and 54, and FIG. 2. Additionally, the system comprises a refresh manager (e.g., refresh manager 126) that performs a refresh operation on the materialized view in multiple steps by successively reading a first subset of the plurality of entries indicated by a specific epoch identifier from the refresh log, identifying a second subset of the plurality of entries from within the first subset of the plurality of entries, the second subset of the plurality of entries falling within a primary key value boundary and applying the second subset of the plurality of entries to the materialized view. *See, e.g.*, Application, paragraphs 37-76, and Figures 2-5.

With regard to the aspect of the invention set forth in independent claim 5, discussions of the recited features of claim 5 can be found at least in the below cited locations of the specification and drawings. By way of example, claim 5 relates to a method of refreshing a materialized view that is in part derived from a table, the method being adapted to improve the availability of the table and the materialized view while the materialized view is being refreshed. The method comprises deriving a materialized view (e.g., materialized view 130) from at least one table (e.g., table 128). *See, e.g.*, Application, paragraphs 2-4, 18, 20-22, 26-33, 37-76 and 81-84, and Figures 3 and 7. The method further comprises assigning an epoch identifier to changes made to the at least one table and storing an entry corresponding to each change to the at least one table in a refresh log (e.g., the excerpt of a refresh log 100) that includes a plurality of entries, each of the plurality of entries comprising an epoch identifier that is adapted to synchronize the refresh log between refreshing operation. *See, e.g.*, Application, paragraphs 28-40 and 54, and Figure 2. Additionally, the method comprises performing a refresh operation (e.g., as performed by the refresh manager 126) in multiple operations, each of the multiple operations comprising successively reading a first subset of the plurality of entries indicated by a specific epoch identifier from the refresh log, identifying a second subset of the plurality of entries from within the first subset of the plurality of entries, the second subset of the plurality of entries falling within a primary

key value boundary and applying the second subset of the plurality of entries to the materialized view. *See, e.g.*, Application, paragraphs 37-76, and Figures 2-5.

With regard to the aspect of the invention set forth in independent claim 9, discussions of the recited features of claim 9 can be found at least in the below cited locations of the specification and drawings. By way of example, claim 9 relates to a system that provides availability of a table (e.g., table 128) and a materialized view (e.g., materialized view 130) while the materialized view is being refreshed, the table being derived at least in part from the materialized view. *See, e.g.*, Application, paragraphs 2-4, 18, 20-22, 26-33, 37-76 and 81-84, and Figures 3 and 7. The system comprises a refresh log (e.g., the excerpt of a refresh log 100) that contains a plurality of entries, wherein the plurality of entries comprise data that is being refreshed, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations. *See, e.g.*, Application, paragraphs 28-40 and 54, and Figure. 2. Further, the system comprises a refresh manager (e.g., refresh manager 126) that computes a table delta based on the refresh log and applies the table delta to the materialized view. *See, e.g.*, Application, paragraphs 37-76, and Figures 2-5.

With regard to the aspect of the invention set forth in independent claim 16, discussions of the recited features of claim 16 can be found at least in the below cited locations of the specification and drawings. By way of example, claim 16 relates to a method of refreshing a materialized view (e.g. materialized view 130) that is derived at least in part from a table (e.g., table 128), the method being adapted to provide availability of the table and the materialized view while the materialized view is being refreshed. *See, e.g.*, Application, paragraphs 2-4, 18, 20-22, 26-33, 37-76 and 81-84, and Figures 3 and 7. The method comprises storing a plurality of entries corresponding to changes in the table in a refresh log (e.g., the excerpt of a refresh log 100), wherein the plurality of entries comprise data that is being refreshed, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations and computing a table delta based on the refresh log. *See, e.g.*, Application,

paragraphs 28-40 and 54, and Figure. 2. Additionally, the method comprises refreshing the materialized view based on the table delta (e.g., T-delta). *See, e.g.,* Application, paragraphs 37-76, and Figures 2-5.

With regard to the aspect of the invention set forth in independent claim 23, discussions of the recited features of claim 23 can be found at least in the below cited locations of the specification and drawings. By way of example, claim 23 relates to a system that provides availability of a table (e.g., table 128) and a materialized view (e.g., materialized view 130) while the materialized view is being refreshed, the table being derived at least in part from the materialized view. *See, e.g.,* Application, paragraphs 2-4, 18, 20-22, 26-33, 37-76 and 81-84, and Figures 3 and 7. The system comprises a refresh log (e.g., the excerpt of a refresh log 100) that contains a plurality of entries, wherein the plurality of entries comprise data that is being refreshed, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations. *See, e.g.,* Application, paragraphs 28-40 and 54, and Figure 2. Additionally, the system comprises means for computing a table delta (e.g., T-delta calculation) based on the refresh log and means for applying the contents of the table delta to the materialized view. *See, e.g.,* Application, paragraphs 37-76, and Figures 2-5.

With regard to the aspect of the invention set forth in independent claim 27, discussions of the recited features of claim 27 can be found at least in the below cited locations of the specification and drawings. By way of example, claim 27 relates to a computer readable medium (e.g., disk). The computer readable medium comprises a refresh log (e.g., the excerpt of a refresh log 100) stored on the computer readable medium, the refresh log containing a plurality of entries, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations, wherein one of the plurality of entries comprises refreshable data associated with a materialized view (e.g., materialized view 130). *See, e.g.,* Application, paragraphs 2-4, 18, 20-22, 26-76 and 81-84, and Figures 2, 3 and 7. The computer readable medium further comprises code adapted to refresh the materialized view at least in part from a

table by computing a table delta (e.g., T-delta calculation) based on the refresh log and applying the table delta to the materialized view. *See, e.g.*, Application, paragraphs 37-76, and Figures 2-5.

6. **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

First Ground of Rejection for Review on Appeal:

The Appellants respectfully urge the Board to review and reverse the Examiner's first ground of rejection in which the Examiner rejected claims 1, 5, 9, 16 and 27 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Second Ground of Rejection for Review on Appeal:

The Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected claims 1-4 under 35 U.S.C. § 101 for including no implementation of computer hardware.

Third Ground of Rejection for Review on Appeal:

The Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claims 1-30 under 35 U.S.C. § 102(b) as being anticipated by Witkowski et al., U.S. Patent No. 6,125,360 (hereafter "Witkowski").

7. **ARGUMENT**

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under 35 U.S.C. §§ 101, 112 and 102. Accordingly, the Appellants respectfully request full and favorable consideration by the Board, as the Appellants assert that claims 1-30 are currently in condition for allowance.

A. **Ground of Rejection No. 1:**

The Examiner rejected claims 1, 5, 9, 16, and 27 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. More specifically, the Examiner stated:

Specifically the phrase “adapted to” renders the claim(s) indefinite because it suggests an option that may or may not happen. Changing the phrase to “configured to” my overcome this rejection.

Final Office Action, page 2.

The Appellants respectfully traverse the Examiner’s assertions regarding the use of the language “adapted to” in independent claims 1, 5, 9, 15 and 27. According to M.P.E.P. § 2111.04, the determination of whether the “adapted to” clause is a limitation in a claim depends on the specific facts of the case. For example, in a claim that was directed to a kit of component parts capable of being assembled, the Court held that limitations such as “members *adapted to* be positioned” served to precisely define structural attributes or interrelated component parts of the claimed assembly. *In re Venezia*, 530 F.2d 956, 189 U.S.P.Q. 149 (C.C.P.A. 1976) (emphasis added), *see also* M.P.E.P. § 2173.05(g). The Appellants assert that the “adapted to” clause recited in the present claims is very similar to that in *In re Venezia*. Accordingly, the Appellants assert that the “adapted to” clauses in claims 1, 5, 9, 15 and 27 each state a relationship or condition that is material to patentability and, thus, cannot be ignored. *See Hoffer v. Microsoft Corp.*, 405 F.3d 1326, 1329, 74 U.S.P.Q.2d 1481, 1483 (Fed. Cir. 2005).

For at least these reasons, Appellants respectfully urge the Board to reverse the rejection of claims 1, 5, 9, 16 and 27 under Section 112, second paragraph.

B. Ground of Rejection No. 2:

The Examiner rejected claims 1-4 under 35 U.S.C. § 101 because no implementation of computer hardware is found in these claims. Specifically, the Examiner asserted that “[t]he lack of computer hardware renders claims 1-4 as being software per se and therefore is nonfunctional descriptive material”.

According to the Supreme Court, congress intended statutory subject matter to “include anything under the sun that is made by man.” *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09; 206 U.S.P.Q. 193, 197 (1980). Indeed, exclusions of statutory subject matter are limited to laws of nature, natural phenomena and abstract ideas. *See Diamond v. Diehr*, 450 U.S. 175, 185; 209 U.S.P.Q. 1, 7 (1981). Other than these specific exceptions, therefore, nearly anything man made is statutorily patentable subject matter under 35 U.S.C. §101.

In determining when process or method claims include statutory subject matter, the Supreme Court in *Diehr* stated that “[t]ransformation and reduction of an article ‘to a different state or thing’ is the clue to the patentability of a process claim that does not include particular machines.” *See id.* 450 U.S. at 183-185, 209 U.S.P.Q. at 6. In addition to the Supreme Court’s transformation and reduction test, the Federal Circuit has developed a second test which may also be used to determine if a claim recites statutory subject matter, namely does the claim produce a “useful, concrete, and tangible result.” *In re Alappat*, 31 U.S.P.Q.2d 1545, 1557 (Fed. Cir. 1994) (*en banc*). The Federal Circuit further elaborated on this second test by holding that one must look to “the essential characteristics of the subject matter, in particular, its practical utility.” *State Street Bank & Trust Co. v. Signature Financial Group Inc.*, 47 U.S.P.Q.2d 1596, 1602 (Fed. Cir. 1998).

However, explaining this “useful, concrete, and tangible” test, the Federal Circuit has stated “the dispositive inquiry is whether the claim *as a whole* is directed to statutory subject matter.” *In re Alappat*, 31 U.S.P.Q.2d at 1557. Indeed, there has been no

requirement from Congress, the Supreme Court, or the Federal Circuit mandating that a *specific final result* be shown for a claim to qualify under Section 101. *See id.* Rather, the Federal Circuit has specifically stated “the *Alappat* inquiry simply requires an examination of the contested claims to see if the claimed subject matter *as a whole* is a disembodied mathematical concept representing nothing more than a ‘law of nature’ or an ‘abstract idea,’ or if the mathematical concept has been reduced to *some practical application rendering it ‘useful’*.” *AT&T Corp. v. Excel Communications, Inc.*, 50 U.S.P.Q.2d 1447, 1451 (Fed. Cir. 1999) (emphasis added). Therefore, if a claim meets either the transformation and reduction test put forth by the Supreme Court, or if the claim, read as a whole and in light of the specification, produces any useful, concrete, and tangible result, the claim meets the statutory requirements of Section 101. *See id.*

The Appellants respectfully assert that the claims 1-4, taken as a whole, each recite statutory subject matter under 35 U.S.C. §101 because they produce a useful, concrete and tangible result. The present Application is directed to methods and systems for refreshing materialized views, whereby updates to the materialized views are collected in a log and are applied periodically. In accordance with the present technique, as recited by the claims, materialized views may become available for queries during the time in which the materialized views are updated. Such a technique improves the availability of materialized views in databases that employ a deferred refresh policy. *See* Application, paragraph 4.

For example, independent claim 1 recites a system comprising “a materialized view that is derived at least in part from a table; a refresh log that contains a plurality of entries, each of the plurality of entries corresponding to a change in the table, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations; and a refresh manager that performs a refresh operation on the materialized view in multiple steps.”

Claim 1, therefore, taken as a whole, recites a system allowing a table and a materialized view to be available for queries while the materialized view is being refreshed. The Appellants assert that increasing the availability of the table and of the materialized views during refresh operations of the materialized views is a useful, concrete and tangible result as it enables performing data queries more efficiently. Accordingly, Appellants respectfully request withdrawal of the rejection of claims 1-4 under Section 101.

Additionally, the Appellants note that while the Examiner did not reject claims 27-30 under 35 U.S.C. § 101, the Examiner stated that the computer readable medium recited in claims 27-30 is interpreted to mean “a volatile medium able to be ready by a computer (i.e. a hardware disk) since it comprises code.” The Examiner made this statement under the heading relating to rejections under 35 U.S.C. § 101. The Appellants address this merely to stress that the recited computer readable medium should not be limited only to “a hardware disk.”

C. **Ground of Rejection No. 3:**

The Examiner rejected claims 1-30 under 35 U.S.C. § 102(b) as being anticipated by Witkowski. The Appellants respectfully traverse this rejection.

Anticipation under 35 U.S.C. § 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 227 U.S.P.Q. 773 (Fed. Cir. 1985). Thus, for a prior art reference to anticipate under 35 U.S.C. § 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). Moreover, the prior art reference also must show the identical invention “in as complete detail as contained in the ... claim” to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added). Accordingly, the Appellants need only point to a single element not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter.

The rejection of claims 1-30 under 35 U.S.C. § 102 is improper because the Witkowski reference fails to teach or illustrate each and every element recited by the present claims. Accordingly, the Witkowski reference cannot anticipate the present claims. By way of example, independent claims 1, 9, 23 and 27 recite a refresh log containing a plurality of entries, “each of the plurality of entries comprising an epoch identifier *adapted to synchronize the refresh log between refreshing operations.*” (Emphasis added.) Similarly, independent claims 5 and 16 recite a method of refreshing a materialized view derived from a table. Particularly, independent claim 5 recites assigning an epoch identifier to changes made to at least one table, wherein the epoch identifier is “*adapted to synchronize the refresh log between refreshing operations.*” (Emphasis added). Further, independent claim 16 recites storing a plurality of entries corresponding to changes in the table such that each of the plurality of entries comprises “an epoch identifier *adapted to synchronize the refresh log between refreshing operations.*” (Emphasis added). Such synchronization of the refresh log is beneficial, for example, in avoiding inclusion of records corresponding to transactions that occurred outside a refresh time range or in omitting records corresponding to transactions that actually occurred within a particular refresh time range.

In contrast, the Witkowski reference does not disclose an epoch identifier adapted to synchronize the refresh log between refreshing operations. At best, the Witkowski reference teaches “a System Change Number [SCN]...a logical number assigned to transactions in commit time order.” *See*, Witkowski, col. 9, lines 17-19. However, Witkowski does not teach or suggest a system adapted to utilize the system change number so as to avoid inclusion of records corresponding to transactions that occurred outside a refresh time range or omit records corresponding to transactions that actually occurred within a particular refresh time range. Moreover, the Witkowski reference clearly does not disclose the claimed epoch identifier adapted to synchronize the refresh log between refreshing operations, so as to obtain a system having the aforementioned benefits.

Based on Appellants' best understanding of the Examiner's rejection, Appellants believe that the Examiner has misinterpreted several terms. For example, an SCN is generally a timestamp for when a transaction was committed. This means that rows of a log table inserted by different transactions will have different SCN numbers. An epoch number, on the other hand, changes only when a materialized view is being refreshed. *See* Application, paragraphs 33-35. Therefore, in many cases, when an refresh operation is approached, all the rows in a log may be of interest (which means they have not already been used for refreshing the materialized view) and will have the same epoch number (or possibly a small number of epoch numbers). Figure 2 of the present application illustrates a log including both an epoch number *and* a timestamp. As would be clear to one of ordinary skill in the art, the SCN of the Witkowski reference and the epoch number of the present application are each utilized in very different ways.

The Appellants also note that the term "steps" is used in the present claims to describe iterations of a refresh operation. *See*, Application, paragraphs 37-76, and Figures 2-5. This was apparently misinterpreted by the Examiner to mean different invocations of the refresh operation rather than different transactions that are part of the same refresh operation. *See, e.g.*, Office Action, page 4. Further, in the Office Action, the Examiner refers to Figure 3 of the Witowski reference as illustrating a refresh manager. *See, e.g.*, Office Action, page 4. However, the Appellants emphasize that the cited figure merely illustrates a generic structure of a computer system with nothing in particular to refresh. Indeed, the cited figure does not even appear to illustrate a database system in general.

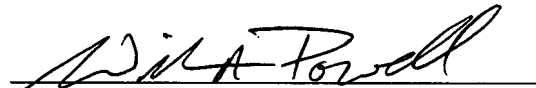
For at least these reason, the Appellants respectfully submit that the Witkowski reference fails to teach each and every limitation set forth in independent claims 1, 5, 9, 16, 23 and 27, as well as those claims dependent therefrom. Accordingly, Appellants respectfully request that the Board overturn the Examiner's rejection of claims 1-30 under 35 U.S.C. § 102.

Conclusion

Appellants respectfully submits that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: September 10, 2007

A handwritten signature in cursive script, appearing to read "W. Allen Powell", is written over a horizontal line.

W. Allen Powell

Reg. No.56,743

FLETCHER YODER

P.O. Box 692289

Houston, TX 77269-2289

(281) 970-4545

8. **APPENDIX OF CLAIMS ON APPEAL**

Listing of Claims:

1. A system that allows a table and a materialized view to be available while the materialized view is being refreshed, the system comprising:

a materialized view that is derived at least in part from a table;

a refresh log that contains a plurality of entries, each of the plurality of entries corresponding to a change in the table, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations; and

a refresh manager that performs a refresh operation on the materialized view in multiple steps by (a) successively reading a first subset of the plurality of entries indicated by a specific epoch identifier from the refresh log, (b) identifying a second subset of the plurality of entries from within the first subset of the plurality of entries, the second subset of the plurality of entries falling within a primary key value boundary and (c) applying the second subset of the plurality of entries to the materialized view.

2. The system set forth in claim 1, wherein the epoch identifiers comprise epoch numbers that have been created since a previous refresh operation on the materialized view.

3. The system set forth in claim 1, wherein the second subset of the plurality of entries is applied to the materialized view in a primary key order.

4. The system set forth in claim 1, wherein the refresh manager is adapted to distinguish between entries of the second subset of the plurality of entries that have already been applied to the materialized view in previous transactions and entries of the second subset of the plurality of entries that have not been applied to the materialized view in the event of a failure of the refresh operation.

5. A method of refreshing a materialized view that is in part derived from a table, the method being adapted to improve the availability of the table and the materialized view while the materialized view is being refreshed, the method comprising:

deriving a materialized view from at least one table;

assigning an epoch identifier to changes made to the at least one table;

storing an entry corresponding to each change to the at least one table in a refresh log that includes a plurality of entries, each of the plurality of entries comprising an epoch identifier that is adapted to synchronize the refresh log between refreshing operations; and

performing a refresh operation in multiple operations, each of the multiple operations comprising (a) successively reading a first subset of the plurality of entries indicated by a specific epoch identifier from the refresh log, (b) identifying a second subset of the plurality of entries from within the first subset of the plurality of entries, the

second subset of the plurality of entries falling within a primary key value boundary and
(c) applying the second subset of the plurality of entries to the materialized view.

6. The method set forth in claim 5, comprising applying the second subset of the plurality of entries to the materialized view in a primary key order.

7. The method set forth in claim 5, comprising defining the epoch identifier to correspond to changes that have been made to the table since a previous refresh operation on the materialized view.

8. The method set forth in claim 5, comprising distinguishing between entries of the second subset of the plurality of entries that have already been applied to the materialized view in previous transactions and entries of the second subset of the plurality of entries that have not been applied to the materialized view in the event of a failure of the refresh operation.

9. A system that provides availability of a table and a materialized view while the materialized view is being refreshed, the table being derived at least in part from the materialized view, the system comprising:

a refresh log that contains a plurality of entries, wherein the plurality of entries comprise data that is being refreshed, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations; and

a refresh manager that computes a table delta based on the refresh log and applies the table delta to the materialized view.

10. The system set forth in claim 9, wherein each of the plurality of entries comprises an epoch identifier.

11. The system set forth in claim 10, wherein the epoch identifier corresponds to changes that have been made to the table since a previous refresh operation on the materialized view.

12. The system set forth in claim 9, wherein the table delta is applied to the materialized view in a primary key order.

13. The system set forth in claim 9, wherein the table delta is used to refresh the materialized view in multiple transactions.

14. The system set forth in claim 9, wherein a primary key value for each entry from the refresh log is recorded after that entry is applied to the materialized view.

15. The system for refreshing the materialized view set forth in claim 9, wherein the refresh manager is adapted to distinguish between a first subset of the plurality of entries that have already been applied to the materialized view in previous

transactions and a second subset of the plurality of entries that have not been applied to the materialized view in the event of a failure of the refresh operation.

16. A method of refreshing a materialized view that is derived at least in part from a table, the method being adapted to provide availability of the table and the materialized view while the materialized view is being refreshed, the method comprising the acts of:

storing a plurality of entries corresponding to changes in the table in a refresh log, wherein the plurality of entries comprise data that is being refreshed, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations;

computing a table delta based on the refresh log;

refreshing the materialized view based on the table delta.

17. The method set forth in claim 16, wherein the table delta is applied to the materialized view in a primary key order.

18. The method set forth in claim 16, comprising updating the materialized view in multiple transactions.

19. The method set forth in claim 16, comprising storing an epoch identifier as a portion of each of the plurality of entries.

20. The method set forth in claim 19, comprising defining the epoch identifier to correspond to changes that have been made to the table since a previous refresh operation on the materialized view.

21. The method set forth in claim 16, comprising recording the primary key value for each entry from the update log after that entry is applied to the materialized view.

22. The method set forth in claim 16, comprising distinguishing between a first subset of the plurality of entries that have already been applied to the materialized view in previous transactions and a second subset of the plurality of entries that have not been applied to the materialized view in the event of a failure of the act of refreshing the materialized view.

23. A system that provides availability of a table and a materialized view while the materialized view is being refreshed, the table being derived at least in part from the materialized view, the system comprising:

a refresh log that contains a plurality of entries, wherein the plurality of entries comprise data that is being refreshed, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations; and

means for computing a table delta based on the refresh log; and

means for applying the contents of the table delta to the materialized view.

24. The system set forth in claim 23, wherein each of the plurality of entries comprises an epoch identifier.

25. The system set forth in claim 24, wherein the epoch identifier corresponds to changes that have been made to the table since a previous refresh operation on the materialized view.

26. The system set forth in claim 23, wherein the means for applying the table delta to the materialized view is adapted to distinguish between a first subset of the plurality of entries that have already been applied to the materialized view in previous transactions and a second subset of the plurality of entries that have not been applied to the materialized view in the event of a failure of applying the table delta to the materialized view.

27. A computer readable medium, comprising:
a refresh log stored on the computer readable medium, the refresh log containing a plurality of entries, each of the plurality of entries comprising an epoch identifier adapted to synchronize the refresh log between refreshing operations, wherein one of the plurality of entries comprises refreshable data associated with a materialized view; and

code adapted to refresh the materialized view at least in part from a table by computing a table delta based on the refresh log and applying the table delta to the materialized view.

28. The computer program set forth in claim 27, wherein each of the plurality of entries comprises an epoch identifier.

29. The computer program set forth in claim 28, wherein the epoch identifier corresponds to changes that have been made to the table since a previous refresh operation on the materialized view.

30. The computer program set forth in claim 27, wherein the refresh manager is adapted to distinguish between a first subset of the plurality of entries that have already been applied to the materialized view in previous transactions and a second subset of the plurality of entries that have not been applied to the materialized view in the event of a failure of a refresh operation.

9. **EVIDENCE APPENDIX**

None.

10. **RELATED PROCEEDINGS APPENDIX**

None.